STEMI Networks of the World: Similarities and Dissimilarities

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3rd Dubrovnik Cardiology Highlights
What the guidelines say!
ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

The Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology

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Organisation of STEMI patient disposal describing pre- and in-hospital management, and reperfusion strategies within 12 h of First Medical Contact (FMC)

Symptoms of STEMI

EMS
- Pre-hospital diagnosis & care
- Ambulance to Cath
- Primary PCI capable centre
- Primary PCI
- Rescue PCI
  - no
  - yes
  - Coronary Angiography 3 to 24 h after FMC - Delayed PCI as required

GP / Cardiologist
- Immediate transfer to Cath Lab

Self referral
- Private transportation
- Non-primary PCI capable centre
  - PCI possible < 2 h
  - yes
  - no
  - Transfer to ICU of PCI-capable centre
  - Immediate fibrinolysis

Successful fibrinolysis?

Joint 2010 ESC - EACTS Guidelines on Myocardial Revascularisation

www.escardio.org/guidelines
# Recommended Delay Times

<table>
<thead>
<tr>
<th>Delay</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred for FMC to ECG and diagnosis</td>
<td>≤ 10 min</td>
</tr>
<tr>
<td>Preferred for FMC to fibrinolysis (‘FMC to needle’):</td>
<td>≤ 30 min</td>
</tr>
<tr>
<td>Preferred for FMC to primary PCI (‘door to balloon’) in primary PCI hospitals</td>
<td>≤ 60 min</td>
</tr>
<tr>
<td>Preferred for FMC to primary PCI</td>
<td>≤ 90 min</td>
</tr>
<tr>
<td>(≤ 60 min if early presenter with large area at risk)</td>
<td></td>
</tr>
<tr>
<td>Acceptable for primary PCI rather than fibrinolysis</td>
<td>≤ 120 min</td>
</tr>
<tr>
<td>(≤ 90 min if early presenter with large area at risk)</td>
<td></td>
</tr>
<tr>
<td>preferred for successful fibrinolysis to angiography</td>
<td>3–24 h</td>
</tr>
</tbody>
</table>

FMC = first medical contact; PCI = percutaneous coronary intervention.
## Logistics for networks

### Table 8. Logistics of prehospital care

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance teams must be trained and equipped to identify STEMI (with use of ECG recorders and telemetry as necessary) and administer initial therapy, including thrombolysis where applicable.</td>
<td>I</td>
<td>B</td>
<td>(43)</td>
</tr>
<tr>
<td>The prehospital management of STEMI patients must be based on regional networks designed to deliver reperfusion therapy expeditiously and effectively, with efforts made to make primary PCI available to as many patients as possible.</td>
<td>I</td>
<td>B</td>
<td>(47)</td>
</tr>
<tr>
<td>Primary PCI-capable centres must deliver a 24/7 service, be able to start primary PCI as soon as possible and within 60 min from the initial call.</td>
<td>I</td>
<td>B</td>
<td>(6, 52, 55)</td>
</tr>
</tbody>
</table>
Organization of Networks

- Clear definition of geographical areas of responsibility;
- Shared protocols based on risk stratification and transportation by trained paramedic staff in appropriately equipped ambulances or helicopters;
- Pre-hospital triage of STEMI patients to the appropriate institutions, bypassing non-PCI hospitals whenever primary PCI can be implemented within the recommended time limits;
- On arrival at the appropriate hospital, the patient should immediately be taken to the catheterization laboratory, bypassing the emergency department;
- Patients presenting to a non-PCI-capable hospital and awaiting transportation for primary or rescue PCI must be attended in an appropriately monitored and staffed area;
- If the diagnosis of STEMI has not been made by the ambulance crew, and the ambulance arrives at a non-PCI-capable hospital, the ambulance should await the diagnosis and if STEMI is confirmed should continue to a PCI-capable hospital.
Figure 1

FMC to mechanical reperfusion (<120 min)

If 120 min is not guaranteed switch to fibrinolytic therapy

FMC to mechanical reperfusion (<90 min)

Recommended maximal time delay in patients referred for PPCI

FMC to mechanical reperfusion (<60 min)

Recommended time delay in patients with STEMI of <2 hrs duration

FMC to pharmacological reperfusion (<30 min)

Injection of the lytic agent
What the reality is!
Proportion of primary PCI patients treated within 2 hours (door-to-balloon=FMC-to-balloon)

Data from NRMI 2–4  n=7133

Patients (%)

Door-to-balloon times (minutes)

~15% 120 min
Median 191 min
Mean 240±174 min

Ottawa Experience
field vs. interhospital transfer

A First Hospital Door-to-Balloon Time

Proportion of Patients (%)

Minutes

Field transfers
Interhospital transfers

P < 0.001

MINNESOTA study: median FMC-to-balloon times


Zone 1: no lytic or half-dose tenecteplase
Zone 2: half-dose or full-dose tenecteplase
Vienna STEMI network (2003-2006)

FMC-to-PPCI time intervals

FMC = DG by 12-lead ECG

TT recommended, if FMC-to-PPCI expected to exceed 90 min

FMC-to-PPCI: 80-90 min

FMC-to-PPCI in self comers to a non-PCI center: 120-160 min
Vienna STEMI registry
Reperfusion strategies, time delay and mortality

Pain-to-first contact <120 min

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Pain-to-first contact</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;60 min (n=190)</td>
<td>4.7</td>
<td>0.24</td>
</tr>
<tr>
<td>61-120 min (n=265)</td>
<td>7.2</td>
<td>0.013</td>
</tr>
<tr>
<td>tt (n=357)</td>
<td>7.3</td>
<td>0.18</td>
</tr>
<tr>
<td>121-180 min (n=106)</td>
<td>11.3</td>
<td></td>
</tr>
<tr>
<td>&gt;180 min (n=51)</td>
<td>17.6</td>
<td></td>
</tr>
</tbody>
</table>

74.3% of STEMI patients referred for PPCI were treated < 120 min

However 8.3% of STEMI patients referred for PPCI received first balloon inflation >3 h later
Danish Registry

Impact of time delay FMC-to-PCI on long-term mortality

Terkelsen et al. JAMA 2010;304:763
Outcome data!
FAST-MI 2005: early mortality according to reperfusion therapy

STEMI (all comers, all treatment): In-hospital mortality
Vienna 1975–2010

TT, thrombolytic therapy; CCU, coronary care unit; ICU, intensive care unit
Data partially based on Kalla K et al. Circulation 2006;113:2398–2405 & Lanschuetzer et al. unpublished
Vienna STEMI Registry
1-year survival rate (2003-2004)
Further improvement!
Delay Times in STEMI Networks

Prehospital fibrinolysis
- Patient delay
- EMS call to arrival on scene
- EMS arrival to needle

Field-triage for PPCI
- Patient delay
- EMS call to arrival on scene
- On scene delay
- Transport delay
- Door-to-balloon (D2B) delay

Health care system delay

Delay Times in STEMI Networks

- Prehospital fibrinolysis
- EMS call to arrival on scene
- EMS arrival to needle
- Field-triage for PPCI
- EMS call to arrival on scene
- On scene delay
- Transport delay
- Door-to-balloon (D2B) delay

Health care system delay

Delay Times in STEMI Networks

Delay Times in STEMI Networks

FMC = Patient seen by a physician or paramedic, 1st diagnostic ECG written and diagnosis STEMI confirmed

Recommended logistics

Pre-hospital triage/care:
- EMS
- Unique telephone number
- Tele-consultation

Ambulance
- 12-ECG recorder/defibrillator
- Staff able to provide basic and advanced life support

Networks:
- Implementation of a network of hospitals with different levels of technology connected by an efficient ambulance service using the same protocol

Targets:
- < 10 min ECG transmission
- < 5 min tele-consultation
- < 120 (< 90) min from FMC to first balloon inflation
- < 30 min start fibrinolytic therapy
Further improvement of logistics

Reduce patient delays
- Permanent public information about symptoms and whom to call ASAP

Reduce EMS / transfer delays (FMC-to-balloon)
- Based on the local situations, bypass non-PCI capable hospitals

Reduce in-hospital delays (door-to-balloon)
- This is important (e.g., bypass ER) but usually does not add most benefit

Organize networks where not available
Network Components

Angina
One number
EMS (car, helicopter)
12-lead ECG, Defibrillator
Basic and advanced life support
Cell phone (direct contact with cath lab)
Trained (emergency) physicians or paramedics
Automatic ECG diagnosis or ECG-telemetry (paramedics)
Pre-hospital treatment (pain relief, UFH, Enox, Bival, pre-h lysis)

Network Organization

Co-operation between EMS, PCI-hospitals, non-PCI hospitals
Lead by cardiologists or emergency physicians
Involvement of (local) health politicians
Public information campaigns
Insurance companies
Financial support
Education
Registry
The Organization, Function and Outcomes of STEMI Networks World-Wide: Current State, Unmet Needs and Future Directions

Kurt Huber, Patrick Goldstein, Christopher B. Granger, Paul Armstrong, and Bernard J Gersh

Eur Heart J 2013 in review
Thank You